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Lubrication

A Technical Publication Devoted to the Selection and Use of Lubricants

THIS ISSUE

Factors Which Relate to Lubrication in the Textile Industry

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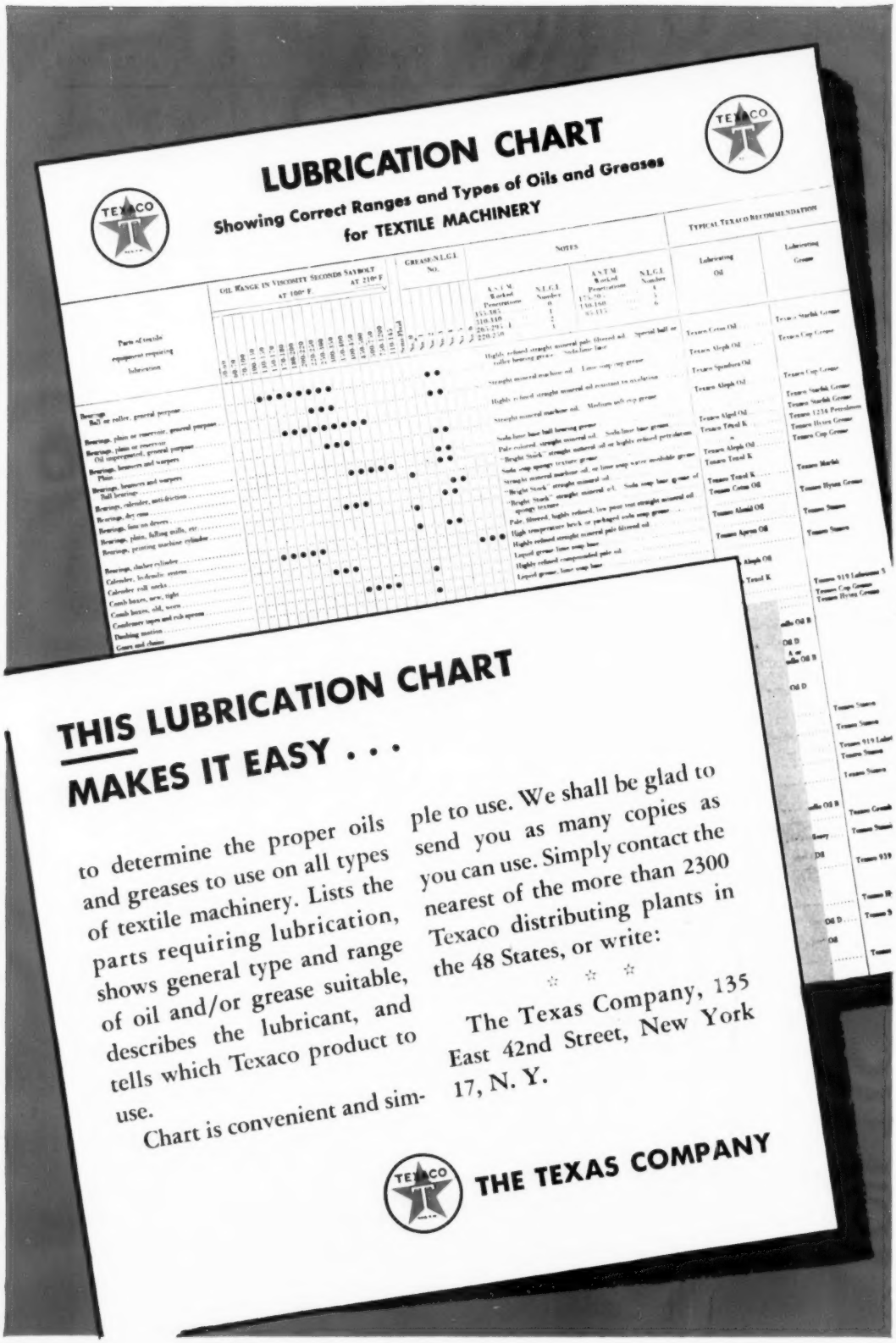

THIS LUBRICATION CHART MAKES IT EASY . . .

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LUBRICATION

A TECHNICAL PUBLICATION DEVOTED TO THE SELECTION AND USE OF LUBRICANTS

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Factors Which Relate to Lubrication in the Textile Industry

MODERN textile machinery involves an assembly of intricate mechanisms, many of them designed to function at high speeds, some of them subject to considerable variations in temperature. Frequently they must operate continuously for long periods of time.

Virtually every process in a modern textile mill is contingent upon some preceding process. This means that the machinery must be properly maintained and adequately lubricated. Lubrication becomes all the more vital when precision mechanisms are involved.

Textile engineers have studied a number of factors which can contribute to more dependable operation and reduce the cost of maintenance. For example:

a—More extensive use of anti-friction bearings.

b—The application of porous bronze bearings.

c—Wider use of centralized, force feed, or automatic lubrication.

d—Hydraulic power as an operating medium.

e—The use of steel precision parts instead of cast iron.

f—Better bracing of machines including shock absorbing.

All relate to the degree of success which will attend the use of petroleum lubricants. The Petroleum Industry therefore, is actively interested in these factors.

Lubrication Must Be Practicable

The idea that lubrication is simply a matter of using a pressure grease gun or seeing that oil goes where it seems to be required, is rapidly being dispelled.

In the lubrication of modern textile machinery the lubricant must be able to work under the operating conditions. In service it must be properly applied — not too much nor too little. How much is "too much" or "too little"? These are details which must be studied by the machinery builders, the bearing manufacturers and the lubrication engineers. Their recommendations should be adhered to.

Always, the machine must be in proper condition to receive effective lubrication. Any slight misalignment, or a rough-running part due to inadequate bracing can render an otherwise suitable lubricant ineffectual.

Selecting the Lubricant

The Petroleum Industry has done excellent missionary work in arousing the interests of mill personnel and machinery builders in more careful selection and more positive application of lubricants. To do this it has been necessary to keep abreast of the trends in machine design and mill operation so that whenever necessary, specialized lubricants could be developed which would give the added protection to the operating parts which improvements in design warranted.

It is interesting to mention those characteristics in lubricants which have been considered as so essential in this regard. For example:

Effective lubrication begins in the drafting room. The modern textile machine designer considers methods of lubrication as carefully as he considers the operating mechanisms he plans to build into the machine. Neither one can be successful without the other.

1—Oxidation Resistance
2—"Stayability"
3—Pumpability (greases)
4—Rust Prevention

Oxidation Resistance

Wider application of precision ball or roller bearings, and the use of oil-impregnated porous metal for sleeve bearings, as retainers for ball bearings, also as twister rings and other specialties, have cast a new light upon the importance of resistance to oxidation, which feature has long been realized as a primary requirement in spindle oils.

When machine parts were of such design as to permit of leakage, the mill management was warranted in regarding quality lubrication as a secondary consideration. They were expected to leak and quite frequent re-lubrication was necessary. To offset leakage heavier-bodied lubricants might be used than the machines required. Harder to handle to be sure, and less likely to leak — at first. But too heavy a lubricant develops friction within itself; sometimes it does not even penetrate to the contact surfaces. Then wear develops, temperatures rise, the lubricant is thinned down and leakage reoccurs as usual. More important, higher spot temperatures may increase the fire hazard.

"Stayability"

All textile machine operations require that the lubricant stay on the working mechanisms and off the fabric. In some operations the ability of the lubricant to adhere to the working surfaces is its most important characteristic. For example, on top rolls of roving frames where application is infrequent and the bearing is located in close proximity to the path of the stock in process. Yet, due to limited space, it is impractical to design these bearings with any appreciable lubricant reservoir capacity.

Another place where frequent oil spot damage occurs is on the looms. Here vibration is the principal cause of splattering of the lubricant. For example, from the dobby-head or jacquard-head where it overhangs the warp.

The ability of a lubricant to stay where it can do the most good, while serving its purpose, must be built into the product at the time it is manufactured. In studying how to best develop this characteristic, the petroleum chemist must know all about how the lubricant is to be applied and the operating conditions under which it must function.

Pumpability

Pumpability, in this discussion of textile machinery lubrication, applies mainly to greases. Pumpability is most important where the grease must pass through fairly long feeder piping in a centralized lubricating system. Pumpability also is important as a time saver where individual lubrication is necessary on parts which must be frequently lubricated.

Ease of pumpability is dependent upon the consistency and texture of the grease. It is affected by temperature; on a cold day a grease which could be very easily pumped normally, would be harder to handle.

Rust Prevention

This has become a very popular topic of conversation in connection with lubricants for the textile industry. Generally speaking, it is a factor where machines operate under high humidity conditions. Rust prevention is most important where highly polished steel working surfaces are involved.

Rust prevention is another characteristic which the petroleum chemist must build into a lubricant when it is being manufactured. This holds true for either oils or greases.

Automatic lubrication is particularly helpful where intricate mechanisms are involved and where failure due to abnormal wear might result in considerable expense, loss of time, or interruption of production schedules.

BALL AND ROLLER BEARING LUBRICATION

In considering the use of ball and roller bearings, the designers of textile machinery always have realized how completely costs of maintenance are controlled by effective lubrication.

A ball or roller bearing is a comparatively well-sealed mechanism. Being thus sealed it normally holds a charge of lubricant satisfactorily. If a high quality product is used, re-lubrication will only be necessary every month or two, according to the design of the bearing. Equally as important, the seal keeps out dust, dirt or other non-lubricating material.

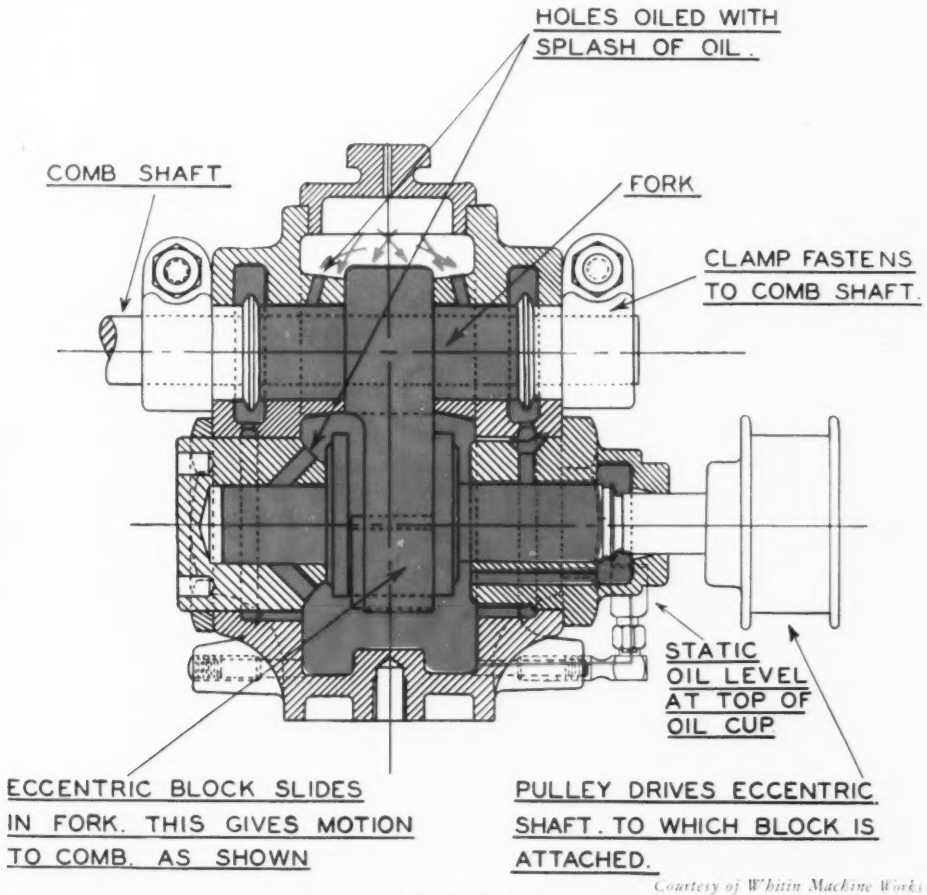
Power saving was the primary objective when anti-friction bearings were first applied to textile machinery on bale breakers, openers and pickers. Other benefits were subsequently observed. The drag on the roll apron of the bale breaker was decreased with consequent increase in the life of the apron; operation throughout was smoother and conducive to the higher speeds which became necessary.

Later, these benefits were further extended when anti-friction bearings were applied to other machines in the industry.

Grease Lubricated Bearings

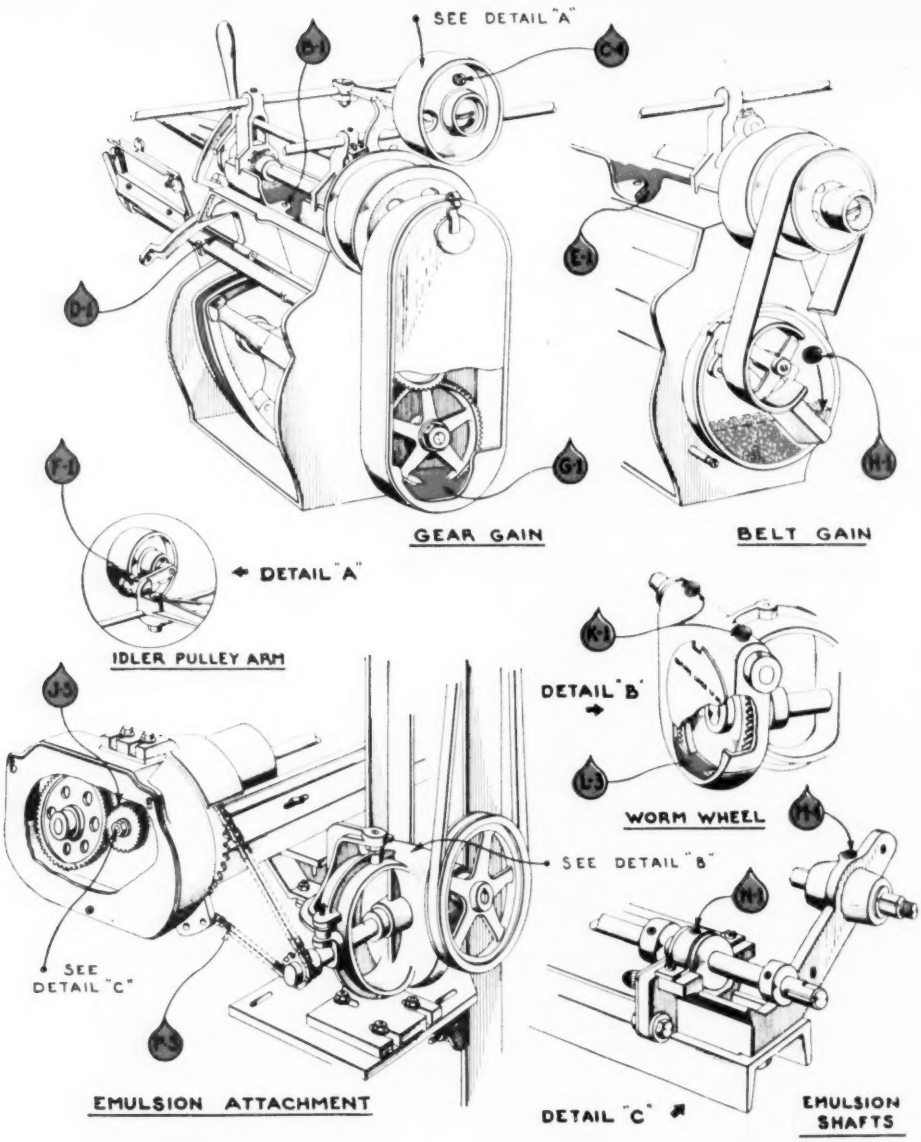
Most of the ball and roller bearings on textile machinery are grease lubricated, being prepacked or provided with means for pressure grease lubrication. Their construction also includes seals to prevent leakage of grease and the possibility of contact with yarn or fabrics.

A grease of medium to heavy consistency is itself an effective sealing medium. In textile service, however, it is best to rely on mechanical means of sealing the bearings, for heavy greases are apt to result in abnormal power consumption. For this reason, a grease of low torque characteristics and medium consistency, which can function under a wide temperature range, is generally best suited to the operating conditions.


HOLES OILED WITH SPLASH OF OIL.
COMB SHAFT
FORK
CLAMP FASTENS TO COMB SHAFT.
STATIC OIL LEVEL AT TOP OF OIL CUP
ECCENTRIC BLOCK SLIDES IN FORK. THIS GIVES MOTION TO COMB, AS SHOWN
PULLEY DRIVES ECCENTRIC SHAFT. TO WHICH BLOCK IS ATTACHED.

Courtesy of Whitin Machine Works

Figure 1—Comb box details of the Whitin design showing relative location of the assembly and provisions for lubrication.



Courtesy of Universal Winding Company

Figure 2—Showing the types of lubricants which are used in the Universal No. 50 Winder as indicated by numbers in Table No. 1 Table No. 2 tells which lubricant should be used at each point and also recommends the ideal lubricating schedule.

Handling the Pressure Gun

The method of application is most important in the maintenance of grease-lubricated anti-friction bearings especially when re-lubrication is necessary. Machinery builders have largely adopted the pressure grease gun for ball and roller bearing lubrication, suitable fittings being located on the bearing housings or connected thereto. This method of pressure lubrication is highly efficient in protecting bearings which can retain a grease charge without leakage. Unfortunately, however, if the pressure gun is not carefully handled too much grease often can be forced into a bearing housing.

Overfilling may cause overheating, due to excessive internal friction within the lubricant itself; this is more noticeable if the grease is too heavy. With certain types of grease, abnormal increase in temperature may cause separation of the oil from the soap, thereby causing marked reduction in lubricating value and loss of oil by leakage.

TABLE NO. 1

SPECIFICATIONS OF LUBRICANTS FOR UNIVERSAL WINDERS

Specification	Lubricant Number #1	#2	#3	#4	#5
Gravity	28	23	25	....	....
Flash	370	360	500	....	....
Pour °F.	10	25	35	....	....
Fire	425	410	600	....	....
S.S.U. Visc. (a 100° F.	120-140	300	....	....	....
S.S.U. Visc. (a 210° F.	40-42	50	150	....	....
Neutralization	.01	0	....	....	....
Emulsion	50	75	....	....	....
Color	Max. #2	Max. #2	....	Amber	....
Carbon	.20 Max.	.03 Max.	.30	....	....
Soap Content	....	....	....	Lime 3%	Lime Base
Penetration, Worked (ASTM)	....	....	....	Semi-fluid	300-350

TABLE NO. 2

LUBRICATION SCHEDULE FOR UNIVERSAL WINDERS

	Frequency	Part	Lubricant
F	Every 40 Hrs.	Idler Pulley Arm ..... 1 drop	#1
D	Every 40 Hrs.	Traverse Bar ..... 1 or 2 drops	#1
K	Every 80 Hrs.	Emulsion Drive Worm Bearings ..... 2 or 3 drops	#1
H G	Every 120 Hrs.	Gainer Case (Belt or Gear Gain) ..... as shown	#1
E	Every 120 Hrs.	Spindle Reservoir (Belt Gain) To overflow hole.....	#1
L	Every 160 Hrs.	Emulsion Drive Worm Wheel..... as shown	#3
B	Every 500 Hrs.	Spindle Reservoir (Gear Gain) To overflow hole.....	#1
N	Every 6 Mos.	Emulsion Roll Shaft Bearings (Wood) ..... 2 drops	#1
C	Every 6 Mos.	Alemite Fittings (Idler Pulleys) ..... Fill	#4
M	Every 6 Mos.	Alemite Fittings (Sprocket Shaft Bearing) ..... Fill	#4
J	Every 6 Mos.	Emulsion Shaft Change Gears..... Smear Lightly	#5
P	Every 6 Mos.	Sprocket Chain ..... Smear Lightly	#5

Do Not Over-Lubricate

Where a ball or roller bearing housing is exposed so that the operators may safely feel of it, the conclusion may often be drawn if it seems too hot, that increase in temperature is due to lack of lubrication. Where a bearing runs warm due to too heavy a grease, however, addition of more lubricant only aggravates the condition. There will also be the danger of forcing some grease past the seals. For this reason, operators should be carefully educated in regard to the lubricating requirements of ball and roller bearings, just as the management should be impressed with the folly of purchasing lubricants mainly on a price basis.

A ball or roller bearing has only a limited capacity for grease. To prevent too frequent greasing, some operators like to use plugs in grease holes instead of pressure gun fittings, the fittings being inserted only temporarily at the regular time for re-lubrication. In this way careless or wasteful use of the grease gun is prevented.

There is no direct method by which the amount of grease applied to an anti-friction bearing can be accurately controlled. Certain types of bearings, however, can be vented to reduce the possibility of imposing the full pressure of the lubricating equipment upon the seals; these latter must, of course, be maintained in suitable condition with respect to the housing if they are to positively prevent leakage of lubricant under continuous operation.

Getting the Most Satisfactory Lubricant

Prediction of lubricant performance is of interest to all concerned; the bearing manufacturer, the

Lubricant control and dependability in the lubricating system is absolutely essential. No matter how perfect the bearings or any other mechanism in a textile machine, if flow or distribution of lubricant is interrupted, serious wear may occur.

lubricating engineer and the operator. Today, greases for ball and roller bearing lubrication must be selected not only from the viewpoint of positive lubrication but also power economy. Practical research into the comparative power consumption developed by certain types of greases in a rotating ball or roller bearing has indicated wide variation.

Research has proved the desirability of combining the art of the grease maker with that of the mechanical engineer when studying grease ingredients. This has resulted in the production of greases which will —

1 — Efficiently resist separation when subjected to violent agitation and the effect of centrifugal force,

2 — Show the least expansion due to entrainment of air, and,

3 — Develop minimum torque or power consumption on starting and during operation.

Low power consumption is most desirable in textile service where several score bearings may often be involved as on certain winders and spinning frames. Obviously, reduction of but a fraction of a horsepower per bearing, by use of a low-torque grease, will have a marked effect upon the ultimate power consumption and the size of motor required.

It is also necessary to give most careful consideration to designing a grease for ball and roller bearings which will effectively resist oxidation so that the bearing manufacturer will be relieved of subsequent complaints due to corrosion or sticking of bearings in storage.

Obviously, such a grease must be practically free from acid-forming tendencies if positive protection of the highly polished metallic surfaces of the balls, rollers and retainers is to be maintained. This necessitates a virtually neutral product and one which contains no fillers. Any oxidation, decomposition and development of free acidity may cause corrosion or pitting of the surfaces of the rolling elements. A grease compounded from a medium viscosity, highly refined straight mineral oil, an additive to inhibit oxidation, and a soap which is suitable to comparatively high temperature service, will resist separation and oxidation effectually, and show a satisfactory low starting and operating torque.

Grease Must Store Well

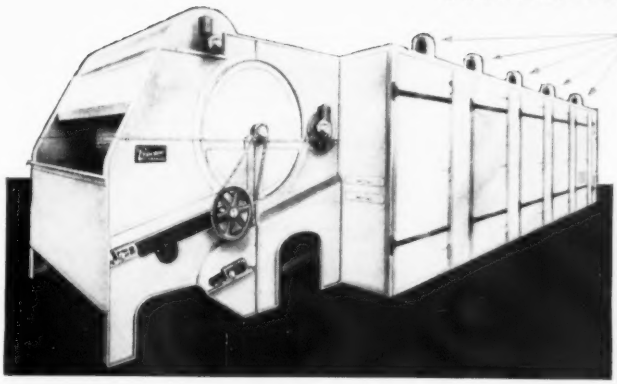
To meet potential demands for bearing replacement in some localities, it is necessary for the manufacturer to keep a considerable stock of such bearings on hand, of size and type conforming to the machinery used in each particular locality. Frequently this stock will involve many bearings which have been grease-packed at the time of manufacture. The length of time replacement bearings of this type may have to be stored may be often over a year. During this period of storage, the grease in the bearing must effectively resist any chemical change in the ingredients.

Long time storage tests to determine the extent to which method of manufacture or the nature of the fatty oil used may affect decomposition or oxidation have been carried on by certain of the bearing manufacturers and members of the Petroleum Industry. These tests have proved that choice of raw materials which are highly resistant to oxidation, along with the use of oxidation inhibitors, are most important adjuncts to ultimate stability of the finished grease. Manufacturing procedure and temperature control also influence the stability.

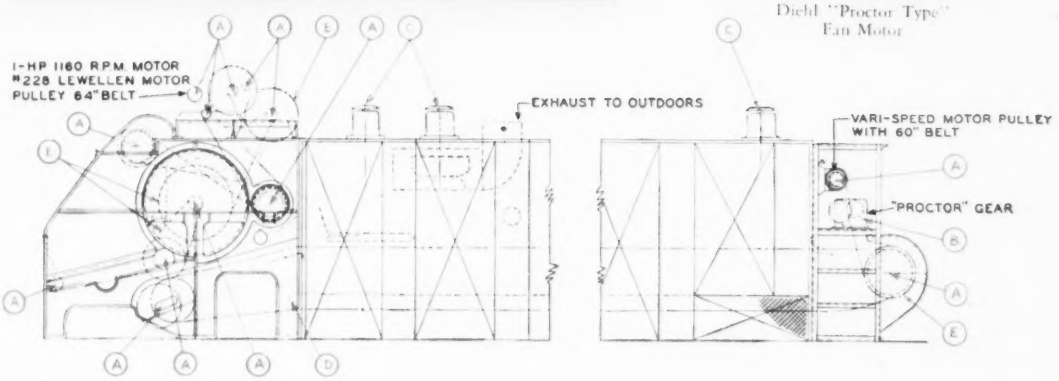
Oil Lubrication

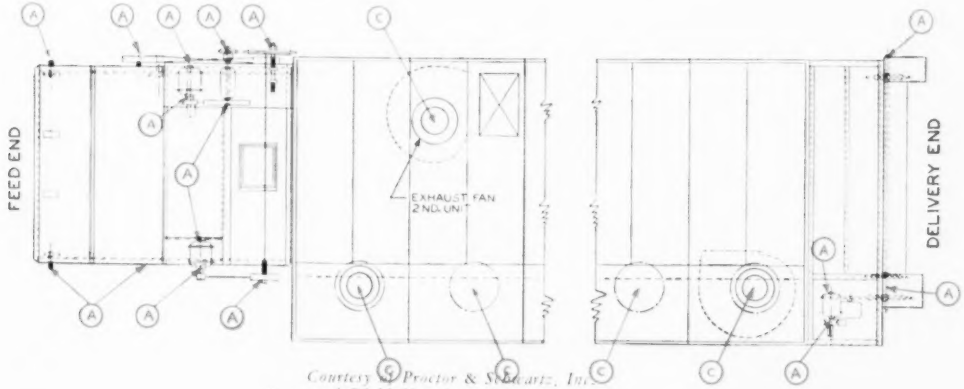
The oil lubricated ball or roller bearing in textile service is confined chiefly to spindle bolsters on spinning and twister frames. Special bearing seals are not necessary as the oil is circulated from the spindle base up to and around the bearing by the turning motion of the spindle. Higher spindle speeds, heavier packages and the correspondingly heavier belt pressures have actuated the interest in this application of the ball and roller bearing.

The Petroleum Industry carefully considers operating conditions and the features of design of textile machinery when deciding upon the type of lubricant to offer for the protection of such machinery.



Diehl "Proctor Type" Fan Motor


1-HP 1160 R.P.M. MOTOR
#228 LEWELLEN MOTOR PULLEY 64" BELT
EXHAUST TO OUTDOORS
VARI-SPEED MOTOR PULLEY WITH 60" BELT
"PROCTOR" GEAR



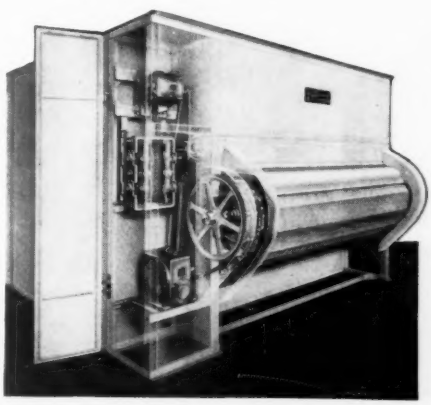
Courtesy of Proctor & Schwartz, Inc. and Diehl Manufacturing Company

Figure 3

THE PROCTOR IMPACT DRYER

Lubrication Guide for Dryer Mechanisms and Diehl "Proctor Type" Fan Motor

(A)—All bearings greased by pressure gun	— Special ball bearing grease
(B) Proctor Gear Reducer	— Steam Cylinder Oil or Non-Corrosive Type Gear Oil (SAE 140)
(C) Diehl "Proctor Type" Fan Motors	
(D)—Grease fittings for SKF Ball Bearings on Diehl "Proctor Type" Fan Motor	— Special Ball Bearing Grease
(E) Chain oiler (Automatic Pump)	— SAE 20 Machine Oil
Roller chains	— Mixture of Graphite Grease + Motor Oil



The oil company lubrication engineer has had wide experience in servicing all sorts of plants in addition to textiles. Many, though different in function, may involve operating conditions similar to those encountered in a textile mill. The lubrication engineer's diversified experience is a valuable asset.

What the Oil Must Do

The best way to protect a spindle bearing is by adequate circulation of the right kind of oil. Unfortunately, the volume is restricted due to the limited capacity of the spindle base. So, the nature of the oil, its refinement and shock-absorbing characteristics must be relied upon. These have been perfected along with resistance to oxidation and vaporization through long and careful research both in the petroleum laboratory and in actual mill operation.

When reduction in power consumption was of chief concern in spindle operation, spindle oils were selected primarily to reduce friction; in other words, on a viscosity basis. Today, however, the oil must serve as a shock-absorbing element to prevent vibration or "hunting," as well as an effective lubricant to prevent wear and reduce power consumption. These objectives can only be attained with an oil which —

a — resists oxidation and gumming.
b — does not vaporize appreciably, and
c — shows a negligible corrosive tendency.

A spindle oil will do all this, provided it is free from those unstable hydrocarbon constituents which are the basic cause of corrosive gums. Continued service under oxidizing conditions, i.e., where air is entrained, accelerates the formation of such gums in poorly refined or carelessly selected oils; at the same time, vaporization of their more volatile components occurs which causes the viscosity to increase. All this will lead to increased friction, abnormal power consumption and excessive spindle wear. Ultimately, it becomes necessary to thoroughly clean the oil ports, reservoirs, and bases to remove these non-lubricating deposits, or even to replace the spindles.

Modern methods of petroleum refining have anticipated these difficulties by removing the readily oxidized materials before the finished spindle oil is put into service.

Surface Finish a Factor

The spindle designer in turn has extended his studies to metallurgy, and the use of carefully selected steels for spindle and bearing construction. He is particularly careful to choose a grade of steel which can be very accurately machined, ground and polished. In this way a more nearly perfect surface is formed, which permits the use of a thinner oil film for lubrication. This promotes minimum power consumption. Furthermore, by enabling the oil film to assume a more uniform degree of thickness, its cushioning or dampening effect is realized, producing less vibration.

Unfortunately, in a plain bearing spindle, the bolster surface cannot be machined with like precision, for it is of cast iron. So the designer uses the highest grade of the latter, which, experience has proved, can be run in to a highly glazed bearing surface. This glaze is quite as important a factor in the reduction of vibration as is the spindle surface. Hence, this polish on the bolster bearing surface must be brought about as soon as possible after the assembly is put into service.

In the anti-friction spindle bearing the required surface finish is an inherent part of the bearing parts at the start.

POROUS METAL BEARINGS

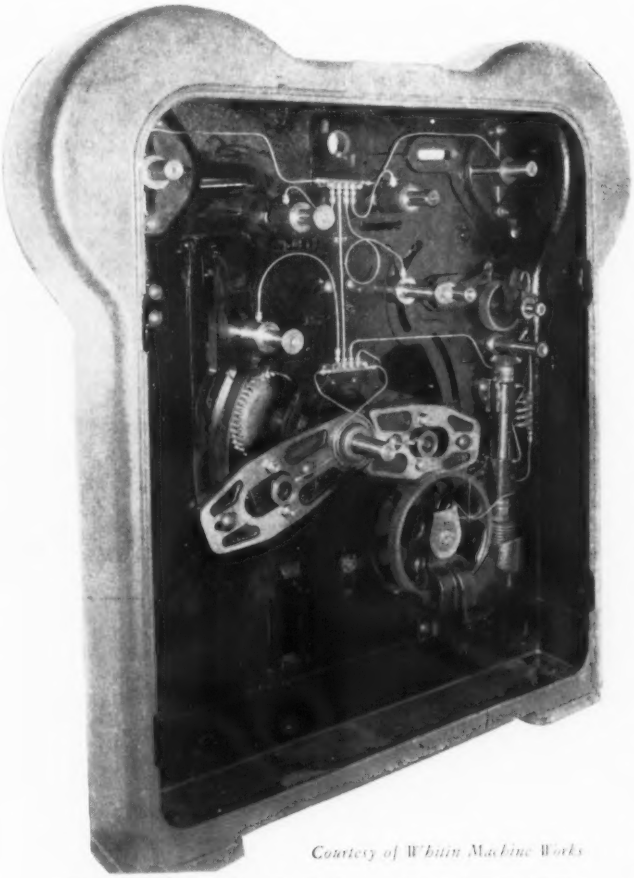
A porous metal bearing acts like a metallic sponge, absorbing and holding a considerable amount of oil — approximately 30 per cent by volume. The materials used can be bronze, iron or aluminum, according to the service and prospective load conditions. The process of manufacture involves pressing the materials (in finely powdered condition) into the desired shape under heavy pressure, sintering the subsequent bearing to give

Seals or guards which will keep lubricants in bearings or gear cases also keep out contaminating foreign matter. A two-fold benefit: fewer oil spots, lower-cost lubrication.

it strength, then impregnating it with highly refined mineral oil which is resistant to oxidation.

Porous metal bearing materials have been well received by the textile industry. Some of the earlier applications involved cages or retainers for ball bearings. More recently there has been successful application to sleeve bearings of spindle bolsters, doffer bearings on cards, etc.

The advantages claimed involve —
— cleanliness
— economy of lubricant
— ease of re-lubrication
— resistance to rust and corrosion
— strength and load-carrying capacity
— ability to retain oil supply indefinitely



Courtesy of Whitin Machine Works

Figure 4—Head end of a Bradford worsted type spinning frame showing the group oiling system.

Re-oiling, when necessary, is suggested at intervals determined by the service. When the bearing material is in good condition it can be fully impregnated by immersion for about fifteen minutes in the right grade of oil heated to around 210° F. In textile sleeve type bearings a viscosity range of from 300 to 500 seconds Saybolt Universal at 100° F. is generally used. For textile ball bearing retainers a somewhat lower viscosity oil is preferred — of spindle oil quality ranging around 100 to 150 seconds.

A highly refined oil should always be used. Don't risk ordinary machine oils. They may be cheaper at first, but they can result in false economy due to oxidation and gumming, which would reduce the porosity of the bearing material and retard its ability to absorb or give up its oil content. The character of the oil should be such that any oxidation products developed in service will be soluble in the oil so that the capillaries of the porous bearing metal will not be plugged.

CENTRALIZED LUBRICATION SYSTEMS

Oil

Application of centralized oil lubrication to textile machinery so far has been confined to looms, spinning frames, roving frames and twisters. Further usage is expected however, in knitting and other service. Oil lubrication under controlled pressure and in controlled amounts is advantageous in that it assures of better protection of the machine parts, greater cleanliness, and economy both of lubricant and labor. Of necessity, however, the lubricating system must involve certain piping control fittings (meter units) and a pumping unit. The pump measures and filters the total quantity of oil fed to the system; the meter units proportion this quantity according to the individual requirements of the bearings. On a textile machine many of the latter are subjected to variable operating conditions, so they require lubrication to meet their individual needs. Control by the meter-fittings accomplishes the desired result.

Actual distribution of the oil to the bearing surfaces is from the inside. Accordingly, there is no tendency to force grit or dirt that has gathered on the outside, into the bearing clearances as might occur with hand oiling. Furthermore, as lubrication is maintained while the machine is in motion oil is applied uniformly over all bearing surfaces. When the machine stops the lubricating system also stops operating, so possibility of oil waste is eliminated. Yet, lubrication is immediately renewed when the machine is restarted as the system starts at the same time.

Greasing Systems

A centralized greasing system involves the idea of piping the grease from a central point of application to many or all of the bearings on a machine. This method of lubrication has been found especially suitable to the end frame bearings on spinning and twisting machinery. When re-greasing is necessary a pressure gun is used, just as on an individual bearing, but a lot of time, labor and waste is saved since re-lubrication is done all at once at one point. It is safer, and the people doing the lubrication stand less chance of missing some important bearing.

The grease, of course, should be of the same high quality as that suggested for ball and roller bearings. In fact a lot of these often are served by a central lubricating system.

HYDRAULIC POWER

Hydraulic power control of certain operating mechanisms on textile machinery has been proposed where greater power and speed is required and where flexibility of control is important. Tension control also is expected to be improved. This would favor hydraulic power in connection with weaving shuttle operation, calender stacks and in certain braiding and knitting machine controls.

In a hydraulic power transmission system, fluid is pumped through a series of piping and control valves to a hydraulic motor which acts as the driving unit; the hydraulic motor converts hydraulic energy into mechanical energy. The cycle is completed by a system of return piping. In this way electric power as delivered by a constant speed electric motor operating in one direction, is converted into hydraulic power and subsequently into mechanical energy of variable speed, capable of most accurate control and direction according to the desire of the operator.

Water was used in the earlier devices involving hydraulic power. Systems applicable to the textile industry, however, work with petroleum oils.

Why Petroleum Oils Are Used

The extension of petroleum oil to hydraulic operation of certain types of power transmission mechanisms has been a most interesting development. The advantages pertinent to use of oil are distinctive in that possibility of interruption of operations due to freezing and rusting is eliminated, lubrication of internal parts is automatically maintained by virtue of the natural lubricating ability of the oils most generally used and a high degree of flexibility and speed control in operation is attainable.

The oil in hydraulic systems is subjected to violent agitation each time it passes through the pump and valve mechanisms. Normally the storage tanks on most equipment are comparatively small, and as a result, the lubricant does not have much chance to rest between cycles. Although the overall temperature of the oil in the hydraulic system seldom gets above 140-160° F., changes in pressure from atmospheric to a thousand or more pounds cause momentary heating of the oil involved to somewhat higher temperatures. For these reasons, it is imperative that the oil used be highly refined, oxidation resistant and not conducive to sludging or foaming. The clearances in most hydraulic pumps are so small that the slightest amount of sludging or rust particles will seriously impair their efficiency.

Courtesy of The Farval Company

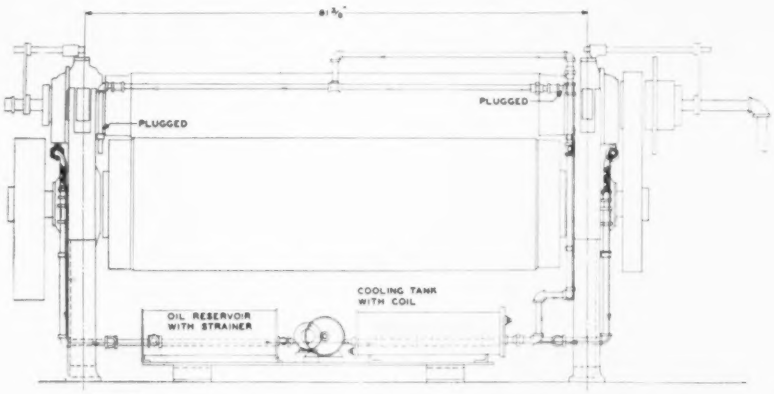
Figure 5—Showing Farval valves on roll neck bearings on a spinning frame.

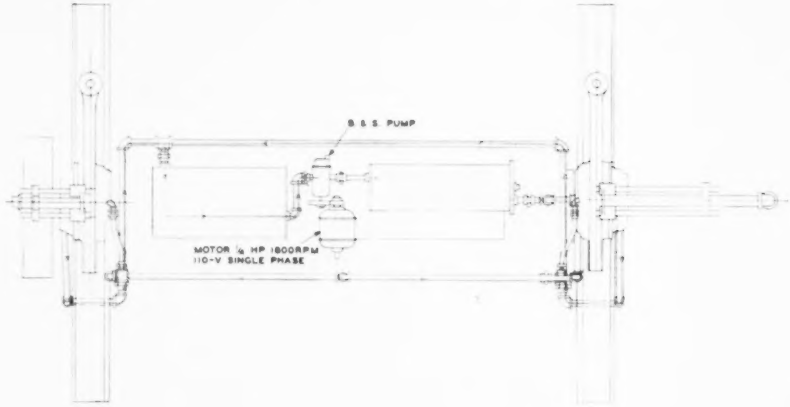
Other equally important properties of hydraulic oils are:—

1 — They must separate quickly from any entrained air as air bubbles are easily compressible and will cause erratic behavior in the controlled mechanism.

2 — They must be non-corrosive to pump valves and other parts of the hydraulic system.

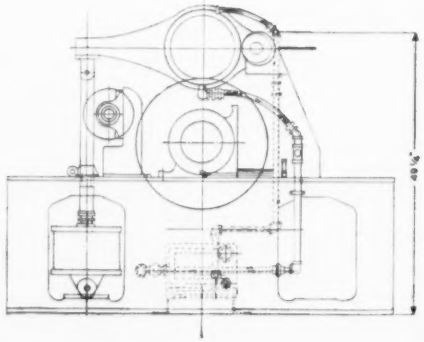
3 — They must separate easily from any moisture in the system.

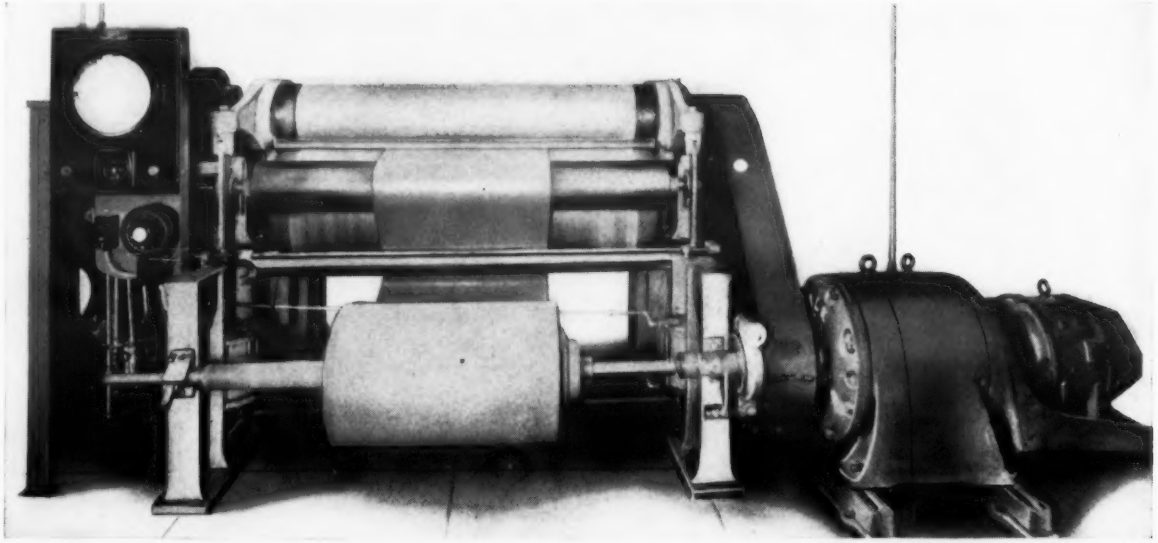




Oil Feed Lines

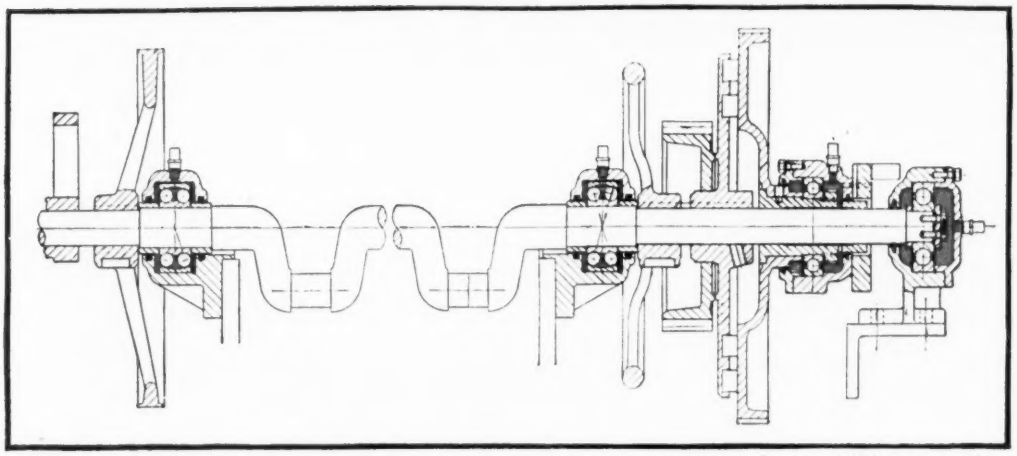
Oil Return Lines





Courtesy of H. W. Butterworth & Sons Co.

Figure 6—Lubrication details for a Buterworth 2-roll embossing calender, showing the oil circulating system.



Courtesy of SKF Industries, Inc.

Figure 7—Self-aligning ball bearings carrying a modern loom crankshaft.

4 — They must prevent rust formation on the internal parts and surfaces of the hydraulic system.

RIGIDITY—SHOCK ABSORBING

Vibration of some types of textile machines can result in serious difficulties. The stability of the building can be affected; machinery parts can be jarred loose or out of alignment; lubricating fittings may shake out of adjustment and even the structure of the machine itself can be damaged.

Hence the trend towards greater rigidity in design. Better bracing, shock absorbers and the use of steel precision parts to replace cast iron are favored in this connection. Bracing loom harnesses, for example, is quoted as contributing to faster operation. Better stability in a working machine also contributes to better lubrication. Were the parts to be lubricated designed so as to stand vibration, it would be different. Too often a loosely fitting sleeve bearing is applied to an important fitting, an oil cup or oil hole is provided, and then the mill man tries to find an oil which will stay put and not vibrate out to drip or splash on the fabric. A good heavy oil may work but when used on a number of such bearings on the same machine, up goes the power consumption. The break-away load when cold-starting can even blow fuses.

CONCLUSION

We have illustrated this discussion of factors which relate to lubrication of textile machinery, with lubrication diagrams. Illustrations of this nature can be used to good advantage by the mill operator in becoming more familiar with his machinery details. Furthermore, he can see at a glance, the parts to be lubricated and, in some cases, the areas contacted by the lubricants. We regret that availability and space limitations did not permit us to show a wider variety of machines.

Textile mill personnel are becoming more and more convinced that protective lubrication is a factor in maintenance economy and the reduction of operating costs.

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